Patent Claims

1. Method for the spectral photometric determination of the oxygen saturation of the blood in optically accessible blood vessels by determining the intensity of the reflection of the blood vessels and their vessel-free environment based on at least two spectrally different images and on an empirically determined relationship between the oxygen saturation and a ratio of the intensities of the reflection of the blood vessels and their vessel-free environment, characterized in that the blood vessels and their environment are illuminated simultaneously by at least one measurement wavelength and at least one reference wavelength of an illumination beam for recording the spectrally different images, and in that every measurement wavelength and reference wavelength is tuned, respectively, to a color channel of a color camera used to record the images in order to be received by this color channel.

2. Method according to claim 1, characterized in that the measurement wavelength is a wavelength at which the reflection of oxygenated and reduced hemoglobin differs, and the reference wavelength is an isosbestic wavelength of the hemoglobin.

3. Method according to claim 2, characterized in that the oxygen saturation is determined as a linear function of the quotient of the logarithmized reflection ratios in the vessel-free environment and on the blood vessel at the measurement wavelength and at the isosbestic wavelength, and in that the slope and linear term of the linear function are determined empirically from readings at a plurality of blood vessels.

4. Method according to claim 3, characterized in that disturbances caused by a dependency of the oxygen saturation on the vessel diameter and on the pigmentation of the environment of the blood vessels are compensated by means of correctives that are empirically determined and taken into consideration additively.

5. Method according to claim 4, characterized in that the corrective for compensating for the influence of the vessel diameter is a linear function of the vessel diameter, and its slope and linear term are determined empirically.

6. Method according to claim 4, characterized in that the corrective for compensating for the influence of the pigmentation of the environment of the blood vessels is

a linear function of the pigmentation, and its slope and linear term are empirically determined.

7. Method according to claim 6, characterized in that the pigmentation of the environment of the blood vessels is determined by the logarithm of the quotient of the reflection values of the environment of the blood vessels at the measurement wavelength and at the isosbestic wavelength.

8. Method according to one of claims 1 to 7, characterized in that arteries and veins are distinguished based on the quotient of the logarithmized reflection ratios in the vessel-free environment of the blood vessel and on the blood vessel at the measurement wavelength and at the isosbestic wavelength.

9. Method according to one of claims 1 to 8, characterized in that the blood vessels, their direction and their vessel-free environment are detected automatically by image-processing means or manually.

10. Method according to claim 9, characterized in that, perpendicular to the direction of the blood vessel, an average is taken over the reflection values of all of the image points associated with the blood vessel.

11. Method according to claim 10, characterized in that a plurality of reflection values which are averaged perpendicular to the direction of the blood vessel is determined along the direction of the blood vessel, and the average is taken over these averaged reflection values.

12. Method according to claim 11, characterized in that specular reflections on the blood vessels are identified and eliminated automatically through image-processing means or manually.

13. Method according to one of claims 1 to 12, characterized in that the oxygen saturation is determined in reaction to physiological provocation or stimulation.

14. Method according to claim 13, characterized in that the physiological provocation or stimulation is brought about by flicker light.

15. Method according to claim 14, characterized in that light from at least one light source is modified through programming techniques by a light manipulator arranged in

an illumination beam path of an image-generating device, and in that the modified light is used for illumination and for selective provocation or stimulation.

16. Method according to claim 13, characterized in that the physiological provocation or stimulation is brought about by inhalation of oxygen by the test subject.

17. Method according to claim 13, characterized in that the physiological provocation or stimulation is brought about by inhalation of carbogen by the test subject.

18. Method according to one of claims 1 to 17, characterized in that an image is prepared of the structure of the blood vessel in which the oxygen saturation is coded.

19. Method according to one of claims 1 to 17, characterized in that an image is prepared of the structure of the blood vessel in which the blood vessels with pathological oxygen saturation are marked.

20. Method according to one of claims 1 to 17, characterized in that a plurality of oxygen saturation values are determined from a tissue area, and results are obtained therefrom by statistical evaluation for oxygen supply and for oxygen consumption in the tissue area.

21. Method according to claims 1 to 17, characterized in that systolic and diastolic differences in oxygen saturation are obtained as diagnostic features by recording pulse-synchronized sequences of images.

22. Method according to claims 1 to 17, characterized in that the oxygen saturation is used in combination with other local or general characteristic values of microcirculation, such as vessel diameter, blood flow rate or blood pressure, to determine the oxygen supply and metabolism in a tissue region.

23. Method for the spectral photometric determination of the oxygen saturation of the blood in optically accessible blood vessels by determining the intensity of the reflection of the blood vessels and their vessel-free environment based on at least two spectrally different images and on an empirically determined relationship between the oxygen saturation and a ratio of the intensities of the reflection of the blood vessels and their vessel-free environment, characterized in that the oxygen saturation is determined as a linear function of the quotient of the logarithmized reflection ratios in the vessel-free environment

and on the blood vessel at a measurement wavelength at which the reflection of oxygenated and reduced hemoglobin differs and at an isosbestic wavelength of the hemoglobin as reference wavelength, and in that the slope and the linear term of the linear function are determined empirically from readings at a plurality of blood vessels.

24. Method according to claim 23, characterized in that disturbances due to a dependency of the oxygen saturation on the vessel diameter and on the pigmentation of the environment of the blood vessels are compensated by empirically determined correctives which are to be taken into account additively.